

Use of Passive-Diffusion bag Samplers to Estimate Vertical Distribution of DNAPL'S

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ABSTRACT NE CONFERENCE

Cost-effective remediation of DNAPLs requires an accurate estimation of their lateral and vertical extent in the subsurface environment. At a tetrachloroethylene (PCE) plume in Milford New Hampshire, vertical strings of water-filled passive diffusion bag (PDB) samplers were used in long-screened (40+ feet) wells to identify the vertical distribution of PCE in a DNAPL source area. The use of PDB samplers permitted identification of chemical stratification in sampled wells that would otherwise have been difficult to identify using conventional sampling techniques that tend to induce vertical mixing.

Seventeen long-screened wells were installed in a rectangular grid pattern covering a 50- by 50-foot area to monitor a DNAPL source area, adjacent to a former dry well where solvents were discharged and leached into an unconsolidated surficial aquifer. Previous vertical profiling using drive point techniques showed that PCE concentrations in the area exceeded 100,000 micrograms per liter (ug/L) suggesting a localized DNAPL source. The subsurface formations at the site are primarily sands and gravels overlying a sloping till layer that, in turn, overlies fractured crystalline bedrock. The long-screened wells span the full-saturated thickness of the sand and gravel and penetrate several feet into the till. Detailed three-dimensional views of the PDB survey, and the previous vertical profiling work, are being constructed to help understand the distribution of PCE and the likely extent of the DNAPL mass.

Vertical strings of 1-foot long PDB samplers were installed 2 ft apart and strung from the water table (approximately 15 feet below land surface) to the well bottom in 5 of the 17 long-screened wells. About 16 to 18 PDB samplers were installed in each sampled well and were allowed to equilibrate for 2 weeks. For comparison of PDB results, small diameter tubes were installed and micropurge samples collected in two wells at positions adjacent to four of the PDB samplers. Micropurge samples were collected after 1-tube volume of water was purged by peristaltic pumps. Standard 40-millimeter vials were used to collect both PDB and micropurge samples. At zones with the highest concentrations of PCE, concentrations were approximately 40 percent greater in PDB samples than micropurge samples, suggesting micropurge methods induced vertical mixing and dilution from adjacent, less contaminated zones.

PCE concentrations from PDB samplers ranged from less than 100 to over 60,000 ug/L. Maximum PCE concentrations were found in the well closest to the former dry well and atop a stratigraphic contact between a coarse-grained layer and a less permeable unit (located about 50 feet below land surface), which is likely the contact with the underlying till. This zone of high PCE levels was approximately 9-feet thick. In this same well, minimum concentrations were below 100 ug/L near the water-table surface (located about 15 feet below land surface). PCE concentrations at a well upgradient of the former dry well (and aforementioned sampled well) were uniformly about 100 ug/L over the entire screen length, whereas at a well downgradient of the dry well, PCE concentrations exceeded 5,000 ug/L over the entire screen length. The extent, location, and vertical distribution of dissolved PCE concentrations, as identified through the application of PDB samplers, suggest a localized DNAPL source in close proximity to the well closest to the former drywell and at a depth about 50 feet below land surface. This information will prove useful in future characterization and remediation efforts in the aquifer.